

REMARKS/ARGUMENTS:

The above-identified patent application has been amended and Applicant respectfully requests the Examiner to reconsider and again examine the claims as amended.

Claims 1-24 are pending in the application. Claims 1-23 are rejected. Claims 1, 9, 15 to 20, and 23 are amended herein. Claim 5 is cancelled herein. Claim 24 is newly added.

FIGS 1, 3, and 3A are amended herein as described above, and specification paragraphs are amended accordingly.

In accordance with the revised provisions of 37 C.F.R. §1.121(c) enacted July 30, 2003 a marked up version of the amended specification and claims is provided hereinabove. Also, replacement sheets for the amended figures and sheets with markings to show changes made are attached.

The Rejections Under 35 U.S.C. §102(b)

The Examiner rejects Claims 9, 15, 17, 19, and 21 under 35 U.S.C. §102(b) as being anticipated by Haneishi (US patent number 5,124,733).

Applicant has amended Claim 9, to require "...that the first and the second patch element can be tuned substantially independently of each other, such that the tuning provided by the one or more upper tuning structures at a first signal frequency is essentially independent of the tuning provided by the one or more lower tuning structures at a second signal frequency." Support for this amendment can be found at page 8, lines 19 to 22.

Applicant submits that Claim 9 is patentably distinct over Haneishi, since the cited reference neither describes nor suggests "....the first and the second patch element can be tuned independently of each other, such that the tuning provided by the one or more upper tuning structures at a first signal frequency is substantially independent of the tuning provided by the

one or more lower tuning structures at a second signal frequency," as set forth in amended Claim 9.

With this particular arrangement, as described at page 3, lines 11-13 ... an antenna array is provided that can operate at two different frequencies wherein each frequency can be effectively and independently tuned and the two frequencies at which the antenna operates can be widely spaced.

In contrast, Haneishi describes copper plates 5a, 5b used for tuning as described at Column 2, lines 46-50 and Column 3, lines 11-13. FIGS. 1-4 show the plates 5a, 5b to be in close proximity or touching each other. Therefore, one of ordinary skill in the art will understand that the copper plates 5a, 5b of Haneishi are electrically coupled. Therefore, Applicant submits that, with the tuning arrangement of Haneishi, it is not possible to tune the resonant frequency  $f_2$  of the second radiating element 4 independently from the resonant frequency  $f_1$  of the first radiating element 3. In other words, if the width of one copper plate of Haneishi is changed (i.e. if the width of plate 5b is changed), the result is a change in resonant frequency of both the first and second radiating elements 3, 4.

In view of the above, Applicant submits that Claim 9 is patentably distinct over Haneishi.

Claims 15, 17, 19, and 21 depend from and thus include the limitations of Claim 9. Thus, Applicant submits that Claims 15, 17, 19, and 21 are patentably distinct over the cited reference generally for the reasons discussed above in conjunction with Claim 9.

Claim 15 is amended herein to require "...a first upper feed coupled to the first patch element, where the upper tuning structures are disposed along an axis and the first upper feed is also disposed along the axis." It is submitted that Claim 15 is further patentably distinct over Haneishi, since the cited reference neither describes nor suggests "...a first upper feed coupled to the first patch element, wherein the upper tuning structures are disposed along an axis and the first upper feed is also disposed along the same axis," as set forth in Claim 15. In contrast, the feed F of Haneishi is disposed offset from the first and second copper plates 5a, 5b.

Claim 17 is amended herein to require "...a first lower feed coupled to the second patch element, where the lower tuning structures are disposed along an axis and the first lower feed is also disposed along the axis." It is submitted that Claim 17 is further patentably distinct over Haneishi, since the cited reference neither describes nor suggests "...a first lower feed coupled to the second patch element, wherein the lower tuning structures are disposed along an axis and the first lower feed is also disposed along the same axis," as set forth in Claim 17.

Claim 19 is amended herein to require "...an upper feed coupled to the first patch element, where the upper tuning structures are disposed along an axis and the upper feed is also disposed along the axis." It is submitted that Claim 19 is further patentably distinct over Haneishi, since the cited reference neither describes nor suggests "...an upper feed coupled to the first patch element, wherein the upper tuning structures are disposed along an axis and the upper feed is also disposed along the same axis," as set forth in Claim 19.

In view of the above, Applicant submits that the rejection of Claims 9, 15, 17, 19, and 21 under 35 U.S.C. §102(b) should be removed.

The Rejections Under 35 U.S.C. §103(a)

Haneishi in View of Smith

The Examiner rejects Claims 10-14, 16, 18, and 20 under 35 U.S.C. §103(a) as being unpatentable over Haneishi in view of Smith (US patent number 4,783,661). The Examiner asserts that "...Haneishi show the stacked patch elements." The Examiner relies upon Smith to teach an array of "four stacked patch antennas" having "separately fed upper and lower patches," and also a "row of pins 15a." With regard to Claim 10, the Examiner concludes, "[S]crews are an obvious substitute for conductive vias and pins..." Also, with regard to Claims 16, 18, and 20, the Examiner concludes that "[I]t would have been obvious to the skilled artisan to pluralize the Haneishi antenna with respective feeders, according to the teachings of Smith."

As the Examiner is aware, and as found in MPEP §2142, in order to establish a prima facie case of obviousness "...the prior art reference (or prior art references when combined) must teach or suggest all the claim limitations." (emphasis supplied) Applicant respectfully submits that the Examiner has not met this burden in order to establish a prima facie case of obviousness.

Each of claims 10-14, 16, 18 and 20 depend directly or indirectly from Claim 9 and thus include the limitations of Claim 9. Applicant thus submits that Claims 10-14, 16, 18, and 20 are patentably distinct over Haneishi, whether taken alone or in combination with Smith, since the cited references neither describe nor suggest one or more upper tuning structures ... and one or more lower tuning structures ... disposed such that ... the first and the second patch element can be tuned substantially independently of each other" as called for in each of Claims 10-14, 16, 18, and 20 respectively.

With this particular arrangement, as described at page 3, lines 11-13, an "...an antenna array is provided that can operate at two different frequencies wherein each frequency can be effectively and independently tuned. Furthermore, the two frequencies at which the antenna operates can be widely spaced."

Although, Haneishi describes at column 2, lines 46-50, a stacked microstrip antenna having first and second radiating elements neither Haneishi nor Smith describe or suggest upper and lower tuning structures which can be used to substantially independently tune first and second radiating elements of a stacked patch antenna as called for in conjunction in Claims 10-14, 16, 18 and 20.

It is submitted that Claim 16 is further patentable over Haneishi, whether taken alone or in combination with Smith, since the cited references neither describe nor suggest "...a second upper feed coupled to the first patch element, where the lower tuning structures are disposed along an axis and the second upper feed is also disposed along the same axis," as set forth in amended Claim 16. In contrast, the feed F of Haneishi is disposed offset from the first and second copper plates 5a, 5b.

It is submitted that Claim 18 is further patentable over Haneishi, whether taken alone or in combination with Smith, since the cited references neither describe nor suggest "...a second lower feed coupled to the second patch element, where the upper tuning structures are disposed along an axis and the second lower feed is also disposed along the same axis," as set forth in amended Claim 18.

It is submitted that Claim 20 is further patentable over Haneishi, whether taken alone or in combination with Smith, since the cited references neither describe nor suggest "...a lower feed coupled to the second patch element, where the lower tuning structures are disposed along an axis and the lower feed is also disposed along the same axis," as set forth in amended Claim 20.

In view of the above, Applicant submits that Claims 10-14, 16, 18, and 20 are patentably distinct over Haneishi, whether taken alone or in combination with Smith.

#### Haneishi in View of Neff

The Examiner rejects Claim 22 under 35 U.S.C. §103(a) as being unpatentable over Haneishi in view of Neff (US patent number 4,697,189).

Claim 22 depends from and thus includes the limitations of Claim 9. Applicant thus submits that Claim 22 is patentably distinct over Haneishi in combination with Neff, since the cited references neither describe nor suggest that the tuning provided by the one or more upper tuning structures at a first frequency range is substantially independent of the tuning provided by the one or more lower tuning structures at a second signal frequency range," as required by Claim 22.

In view of the above, Applicant submits that Claim 22 is patentably distinct over Haneishi, whether taken alone or in combination with Neff.

#### Haneishi in View of Schneider

The Examiner rejects Claim 23 under 35 U.S.C. §103(a) as being unpatentable over Haneishi in view of Schneider et al. (US patent number 6,218,989). The Examiner asserts that Schneider et al. shows it to be obvious to "...pluralize a basic patch antenna element, such as in Haneishi, into a four-square array." The Examiner also relies upon Schneider to teach "...[t]he feeders 11, 11a-d are taught to be connected to the electronics...which include 'combiner circuits' for providing circular polarization." The Examiner concludes, "[I]t would have been obvious to pluralize the Haneishi antenna for circular polarization as taught by Schneider et al."

Claim 23 depends from and thus includes the limitations of Claim 9. Thus, applicant submits that Claim 23 is patentably distinct over Haneishi in combination with Schneider et al., since the cited references neither describe nor suggest ...the first and the second patch element can be tuned substantially independently of each other, such that the tuning provided by the one or more upper tuning structures at a first frequency range is substantially independent of the tuning provided by the one or more lower tuning structures at a second frequency range," as required by Claim 23.

Schneider et al. in View of Marie et al.

The Examiner rejects Claims 1-5 under 35 U.S.C. §103(a) as being unpatentable over Schneider et al. in view of Marie et al. (French patent number 2650442). The Examiner asserts that Schneider shows "...an antenna comprising a substrate 6 with opposing surfaces that mount a plurality of patch antenna 9a-d and a ground plane 2, respectively, and at least one rectangularly-shaped surface wave control structure 15a..." The Examiner relies upon Marie et al. to teach "...a triangularly-shaped surface wave control structure 7." The Examiner concludes that "[I]t would have been obvious to the skilled artisan to employ the specific geometry of the structure 15a of Schneider et al as taught by Marie et al to be triangularly-shaped."

Applicant has amended Claim 1 to incorporate the limitations of original Claim 5, requiring "...at least one surface wave control structure has a triangular cross section in a plane perpendicular to said substrate, and an apex at a pre-determined distance above the first surface of said substrate, wherein the apex has a pre-determined apex angle, wherein the apex is at a

distance between 0.1 and 1.0 inches above the substrate, and the apex angle is between 5 and 30 degrees. Support for this amendment can be found at page 5, lines 27-29.

Applicant submits that Claim 1 is patentably distinct over Schneider et al., whether taken alone or in combination with Marie et al., since the cited references neither describe nor suggest "...at least one surface wave control structure .. having a triangular cross section ... and an apex at a at a distance between 0.1 and 1.0 inches above the substrate, and an apex angle is between 5 and 30 degrees," as required by amended Claim 1.

In contrast, Schneider et al. describes in conjunction with FIG. 1, at column 3, lines 13-16, patch antennas separated by a septum 15a having a rectangular cross section and therefore having no "...apex at a distance between 0.1 and 1.0 inches above the substrate, and the apex angle is between 5 and 30 degrees," called for in Claim 1.

The Examiner asserts that Marie et al. shows a triangularly shaped surface wave control structure 7. Marie partition 7 having a height of 290 mm for frequencies between 8 GHz and 12 GHz, and apparently having a substantially triangular cross section. With regard to Claim 5. The Examiner also asserts that "...specific height and apex angle of the triangularly shaped structure 7 in Marie et al are obvious design constraints dependent upon the amount of electric field to be suppressed." Applicant respectfully disagrees.

The structure of Marie et al. is described to operate in a range of 8 GHz to 12 GHz, and the partition 7 has a height of 290 mm. In contrast, for the present invention, it is described at page 5, lines 24-24 that " [I]n a particular embodiment where the array antenna operates at frequencies in the range of about 1 to 1.5 GHz, the surface wave control structure 16b is provided having a height H of 0.6 inches, and an apex angle  $\theta$  of 12 degrees. In other embodiments, the height H can be in the range 0.1 to 1.0 inches, and the apex angle  $\theta$  can be in the range of 5 degrees to 30 degrees." Therefore, the surface wave control structure of the present invention has a height approximately ten times less than the partition of Marie et al., although the present invention operates at a frequency approximately ten times lower than Marie et al.

Applicant submits that one of ordinary skill in the art will understand that antenna structures, whether used for radiation, shielding, or surface wave suppression, generally have a size that is proportional to operating wavelength, i.e., inversely proportional to operating frequency. Therefore, in arguendo, if one were to combine the inventions of Schneider et al. and Marie et al., the outcome would not be the present invention. In contrast, Applicant submits that, because Schneider et al. can operate at a frequency approximately ten times lower than Marie et al., and therefore with a longer wavelength, if Marie et al. were combined with Schneider et al., the result of "obvious design constraints" suggested by the Examiner would be a partition with a height approximately ten times greater than the partition of Marie et al., or 2900 mm, which is nearly 100 inches, far greater than the claimed 0.1 to 1.0 inches of the present invention.

In view of the above, Applicant submits that Claim 1 is patentably distinct over Schneider et al., whether taken alone or in combination with Marie et al.

Claims 2-4 depend from and thus include the limitations of Claim 1. Thus, Applicant submit that Claims 2-4 are patentably distinct over the cited references generally for the reasons discussed above in conjunction with Claim 1.

In view of the above, Applicant submits that the rejection of Claims 1-8, 10-14, 16, 18, and 20-23 under 35 U.S.C. §103(a) should be removed.

Claim 24 is new in the application. Claim 24 depends from and thus includes the limitations of Claim 9. Thus, it is submitted that Claim 24 is allowable over the cited references of record in this case generally for the reasons discussed above in conjunction with Claim 9.

It is submitted that Claim 24 is further patentably distinct over the cited references of record in this case, whether taken alone or in combination, since the cited references neither describe nor suggest "...at least one surface wave control structure disposed on a first surface of said isolation structure and between an adjacent pair of the one or more stacked patch assemblies, where said at least one surface wave control structure has a triangular cross section



in a plane perpendicular to said substrate, and an apex at a pre-determined distance above the first surface of said substrate, wherein the apex has a pre-determined apex angle, wherein the apex is at a distance between 0.1 and 1.0 inches above the substrate, and the apex angle is between 5 and 30 degrees," as set forth in Claim 24.

In view of the above amendment and remarks, Applicant submits that Claims 1-24 and the entire case are in condition for allowance and should be sent to issue and such action is respectfully requested.

If the Examiner has any questions regarding this Amendment or this application, he or she is respectfully invited to telephone the undersigning attorney.

The Assistant Commissioner is hereby authorized to charge payment of any additional fees associated with this communication or credit any overpayment to Deposit Account No. 500845.

Dated: Dec 2, 2003

Respectfully submitted,

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Appl. No. 10/086,305  
Reply to Office Action of August 6, 2003

Docket No. MIT-105PUS

Appendix

Replacement Sheets for FIGS. 1, 2, 3 and 3A

Annotated Showing Changes for FIGS, 1, 2, 3 and 3A

Copy of Letter to Chief Draftsman